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CALORIC PROPERTIES OF DIMETHYL ETHER AND TRIETHYLENE GLYCOL SOLUTIONS

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The real working fluids of vapor compression refrigeration equipment are the solutions of refrigerants in compressor oils (ROS). Additives of compressor oil significantly affect the thermodynamic properties of the refrigerant and the energy efficiency of the compressor system. The optimum choice of working fluids is an important way to increase the efficiency of refrigeration equipment.

Prediction of thermodynamic properties of the ROS is difficult for several reasons. Firstly, there is no information on the composition of the compressor oil. Secondly, there is only a small amount of available information in the literature on the critical (pseudocritical) parameters for the thermally unstable compressor oils. These difficulties can be avoided by studying of the «model» thermodynamic systems that simulate properties of the ROS.

The main requirements to the «model» substance that simulate properties of the compressor oil are following: the availability of information about critical parameters; low values of the vapor pressure in the range of operating parameters of the refrigerating equipment; high molecular weight which can be found in the literature; unlimited miscibility with the refrigerant over a wide temperature range. In this report, we experimentally investigate the solution of dimethyl ether (DME), CAS №115-10-6 in triethylene glycol (TEG), CAS №112-27-6, which fully satisfies for the requirements listed above.

Caloric properties of the working fluids determine the efficiency of technological refrigeration processes. However, currently published methods to predict the heat capacity of refrigerant / compressor oil solutions are insufficiently developed and require further improvement.

New experimental data for the heat capacity on the saturation line for TEG, DME and DME/TEG solutions have been reported. Investigation of the two-phase region heat capacity was carried out on the experimental setup that realizes method of direct heating in adiabatic calorimeter. Experimental data for the heat capacity for pure DME, TEG and DME/TEG solutions in temperature range from 152 to 324 K at mass fractions of DME 20.85 %, 23.98 %, 24.53 %, 50.69 %, 50.91 %, 74.64 %, 74.69 % was obtained. The analysis shows that the mean uncertainty of the experimental data for the two-phase region heat capacity does not exceed 0.75 %. The data of isochoric heat capacity on the liquid saturation line, saturation heat capacity, isobaric heat capacity on the liquid saturation line, enthalpy and entropy for pure DME, TEG and DME/TEG solutions was obtained using the information on the two-phase region isochoric heat capacity. The methodology for predicting the caloric properties of ROS was developed. The influence of compressor oil additives on the caloric properties of DME and the efficiency of the compressor system has been studied.